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(54) Method of making panels, apparatus for carrying out the method and panels obtained thereby.

(57) The invention relates to a method for making panels which may or may not be used for subsequent molding, to the apparatus for providing this method and to the panels obtained thereby. The method comprises the steps of forming a mixture of thermoplastic resin and organic filler and the plastication of this mixture performed simultaneously with its formation. During the transfer of the organic filler to the subsequent mixing and plastication step, the same is desiccated and mixed. Moreover, during said mixing and plastication step to plasticated mixture is transferred to a subsequent extrusion step. The method is carried out in an apparatus including a single device (6) for the continuous production of a sheet (27) of extruded material.

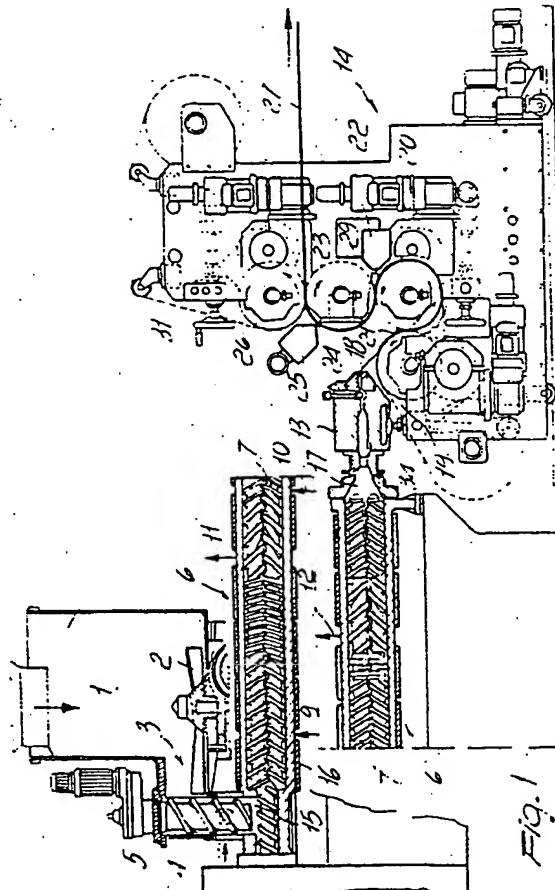


Fig. 1

re-mixing and the desiccation of the raw organic filler material, effected during the transfer of the organic filler to the mixing and plastication step. The latter, according to a further characteristic of the method according to the invention, is in turn performed during the transfer of the mixture of filler and thermoplastic resin to the subsequent extrusion step. Said organic filler, according to a further characteristic of the method according to the invention, is 60 to 80% by weight of the final mixture.

The apparatus for carrying out this method is substantially characterized in that it provides a single device for the continuous production of a slab of extruded material obtained starting directly from fragments of humid organic filler of irregular shape and size, and a melted thermoplastic resin.

The panels obtained according to the method and the apparatus described above are also object of the present invention and are substantially characterized in that they are provided with adapted protective coatings on their outer surface, as well as with a reinforcement material embedded in their thickness.

In fact, according to the present invention it has been surprisingly discovered that, starting from a melted thermoplastic resin and performing its mixing with an organic filler simultaneously with the plastication step, it is possible to use more than 60% by weight of organic filler having even irregular starting size and dimensions. The organic filler mixing the desiccation step provided continuously in the same mixing, plastication and extrusion apparatus allows to start from a still-humid organic filler but without the use of desiccation, storage and transfer units which are instead normally required in traditional devices of this kind. The transfer of the material to the extrusion step, performed simultaneously with the mixing and plastication steps, also has the advantage of making the process according to the invention generally rapid and simple, and of making the apparatus according to the invention less expensive and complicated.

The invention is now described with reference to the figures of the accompanying drawings, which illustrate a preferred embodiment of the apparatus for making panels usable for re-moulding, given only by way of non-limitative example of the invention, wherein:

figure 1 is a longitudinal cross section view of the apparatus according to the invention;

figures 2 and 3 are transverse cross section detail views of the apparatus of figure 1, respectively at its degassing region and at its resin feed region; and

figure 4 is a perspective view in partial cross section of a panel usable for re-moulding obtained with the apparatus of figure 1.

The apparatus according to the invention com-

prises a tank 1 provided at the bottom with a rotatable blade 2 and with a lateral opening 3. At the latter there is a vertical material transfer conduit 4 controlled by a screw or volute feeder 5. The conduit 4 substantially connects the inner chamber of the tank 1 with the chamber of a device 6 inside which is provided a double volute or worm screw 7 with counterposed rotation. For the sake of ease and clarity of description, the double volute 7, which in use has screws arranged side-by-side on a horizontal plane (see figures 2 and 3), is illustrated in figure 1 with screws or volutes arranged on a vertical plane. The form, the dimensions and the pitch of the screw of the volute 7 vary along its length so as to treat the material being processed in different manners according to its position inside the device 6. On the latter the resin feed sections 9 and 10 (figure 3) and the degassing sections 11 and 12 (figure 2) are also defined. These sections are in particular provided with small channels 32, 33 respectively for the ingress of resin into the device 6 and for the discharge of the vapors from the latter. At the end of the device 6 opposite to the end 15 connected to the tank 1 there is an extrusion head 13 downstream whereof is provided a lamination complex 14 which will be described in greater detail hereinafter.

The organic filler is fed inside the tank 1. The filler is composed of wood fragments (shavings, wood powder sawdust) still humid and with irregular size and shape. It can be seen that neither the degree of humidity of the filler nor the dimensions of the possible aggregation between fragments are critical, so that it is possible to bulk feed the wood fragments to the tank 1 without having to perform a previous sifting or a verification of its degree of humidity.

By virtue of its rotation, the blade 2 causes the advancement of the wood fragments towards the lateral opening 3, from which they fall along the conduit 4 towards the inner chamber of the device 6; the screw or volute feeder 5 substantially has the function of metering the amounts of organic filler discharged into the device 6. In the portion of the double volute 7 comprised between the section 15 for the inlet of the organic filler into the device 6 and the resin supply section 10, the wood fragments are subjected to the following treatments: they are heated by the heater plates 16 provided on the skirt of the device 6, they are mixed favoring thereby the formation of a uniform organic mass and facilitating the removal of humidity, and are finally conveyed towards the further processing steps. In this first portion of the device, there substantially occurs a desiccation of the wood shavings, their treatment, so as to make the mass formed thereby homogenous and uniform, and their movement along the device 6. This first portion

8. Method according to claim 1, characterized in that during said single mixing and plastication step the mixture is heated and the vapors thus formed are removed.

9. Method according to claim 1, characterized in that the lamination of the extruded stratified material provides the application thereon of outer finishing and protective layers and the embedding into its thickness of reinforcement elements.

10. Apparatus for carrying out a method of making panels starting from a thermoplastic resin and an organic filler, comprising a single device for the continuous production of a sheet of extruded material (18) obtained starting directly from fragments of organic filler and a thermoplastic resin in a melted state.

11. Apparatus according to claim 10, characterized in that said single device consists of a double volute (7) with counterposed rotation comprising a first organic filler mixing and desiccation portion, a second portion for formation of a thermoplastic resin and organic filler mixture and for the plastication of said mixture, and finally an extrusion head (13), said double volute (7) simultaneously performing the transfer of the organic filler from the first to the second portion, and the transfer of the plasticated mixture to the extrusion head (13).

12. Apparatus according to claim 11, characterized in that said device is provided, at said first and second portion thereof, with degassing sections (11,12), and a section (10) for the feed of the melted thermoplastic resin into said second portion.

13. Apparatus according to claim 12, characterized in that said device is furthermore provided with a section (9) for feeding thermoplastic resin to said first organic filler mixing and desiccation portion.

14. Apparatus according to claim 10, characterized in that the feed of organic filler to the device is controlled by a volute device (4,5), said device furthermore comprising, at the opposite end, an extrusion head (13).

15. Apparatus according to claim 10, characterized in that a lamination device (14) is furthermore provided comprising a plurality of counterposed rollers (19,20,23,26) as well as film heads (22) to laminate the extruded layer (18) of material and to cover it with finishing materials (31).

16. Apparatus according to claim 15, characterized in that said lamination device (14) is provided with means for dispensing a reinforcement material (34) adapted to be embedded in the thickness of the extruded sheet-like material (18) at the counterposed roller (19,20).

17. Apparatus according to claim 15, characterized in that the rollers (19,20) of said lamination device (14) are arranged below said extrusion head (13) of the device so as to receive said layer of

material (18) by gravity feed, thereby partially accumulating said material at the entry section of the device into the section of passage between the rollers (19,20).

18. Panel obtained with the method and the apparatus according to the preceding claims, characterized in that it comprises a layer of sheet-like material (18) containing from over 60% to 80% by weight of organic filler and from below 40% to 20% by weight of thermoplastic resin.

19. Panel according to claim 18, characterized in that layers of finishing material (29, 31) are provided on its outer surfaces.

20. Panel according to claim 19, characterized in that said finishing layers (24,29,31) are composed of thermoplastic material film and of other protective material, a reinforcement being provided embedded in the thickness of said layer.

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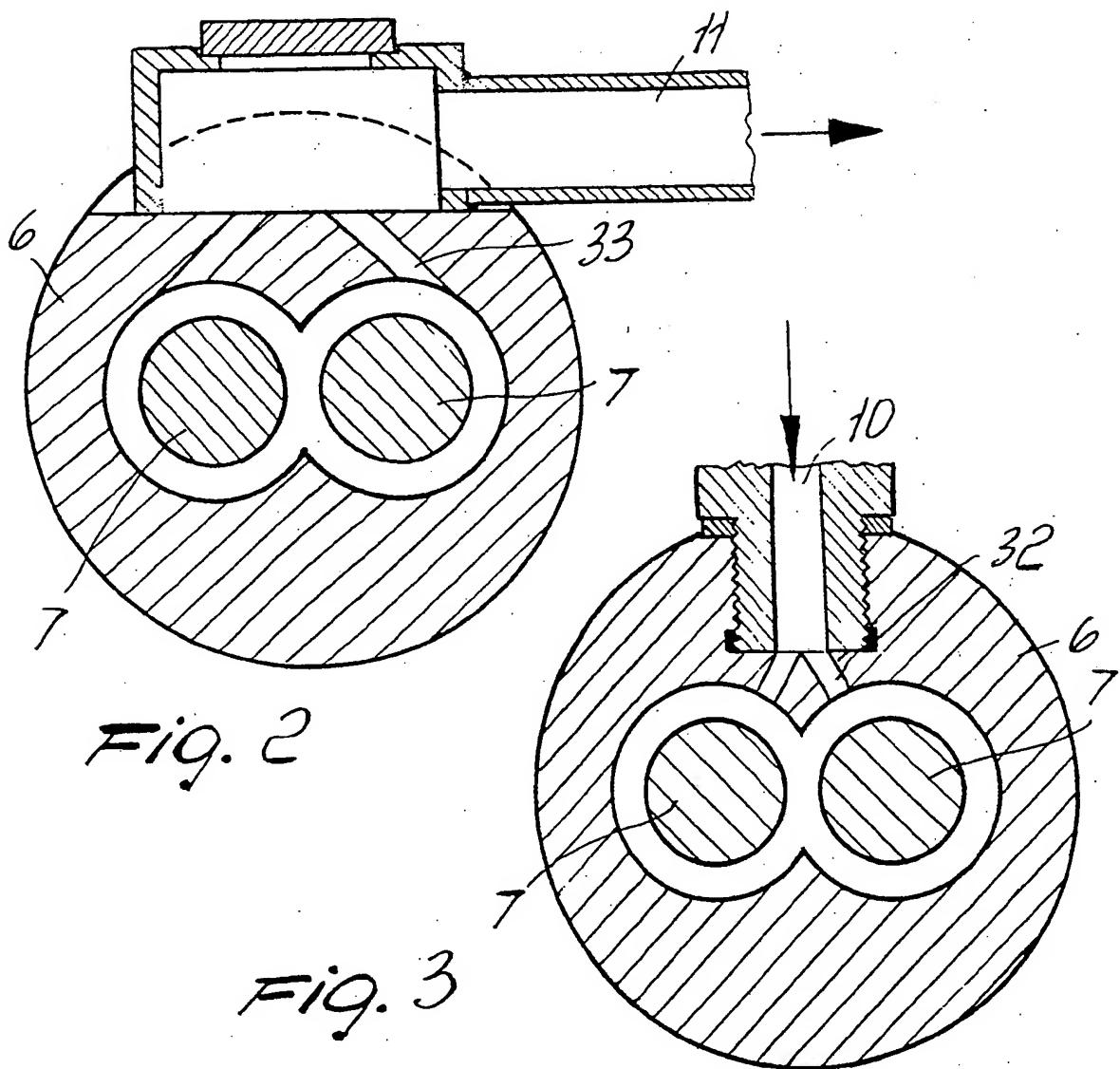
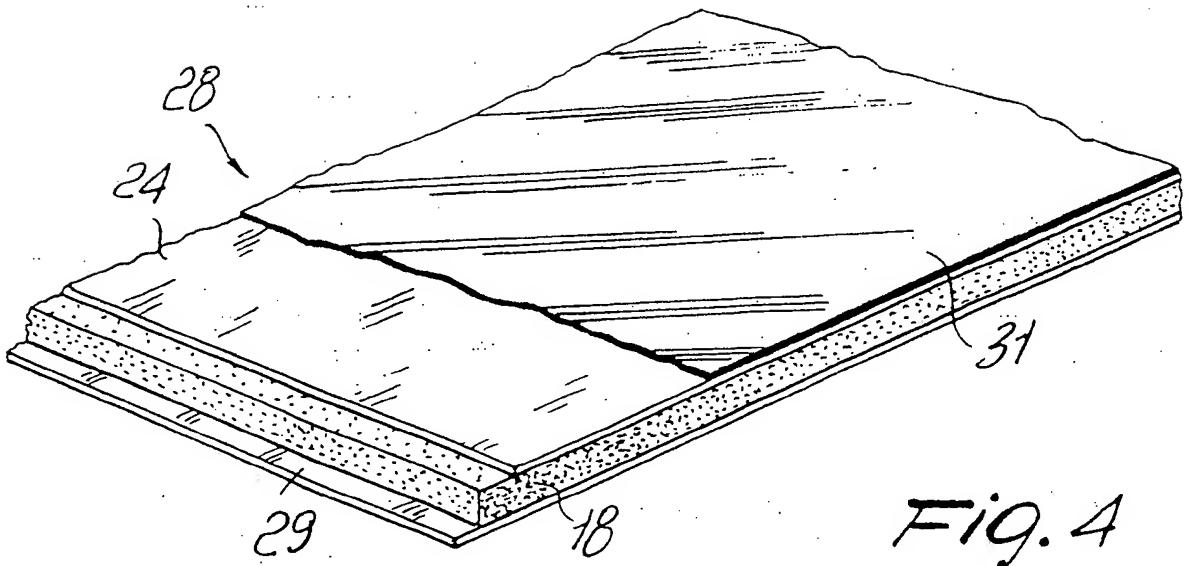
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## EUROPEAN SEARCH REPORT

EP 87 10 7557

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	FR-A-1 150 868 (A. FASTOME) * Figures * -----	9, 15-20	
TECHNICAL FIELDS SEARCHED (Int. Cl.4)			
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search		Examiner
THE HAGUE	18-01-1988		BELIBEL C.
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			